IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Inventors: Barton James Jenson et al.

Serial No. 10/622,197

Filed: July 17, 2003

For: VISUAL DISPLAY SYSTEM FOR DISPLAYING VIRTUAL IMAGES ONTO A FIELD OF VISION

Examiner: Prabodh M. Dharia

Group Art Unit: 2673

Docket No. 35026.001

Date: December 16, 2005

APPEAL BRIEF

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P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This appeal is from the decision of the Examiner, in an Office Action mailed June 23, 2005, finally rejecting claims 1-17 and 19-21.

REAL PARTY IN INTEREST

The real party in interest is Big Buddy Performance, Inc., having a principal place of business at 15815 Woodinville Redmond Rd. NE, Woodinville, WA 98072.

RELATED APPEALS AND INTERFERENCES

Applicants' representative has not identified, and does not know of, any other appeals of interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

Claims 1-17 and 19-21 are pending in the application. Claims 1-17 and 19-21 were finally rejected in the Office Action dated June 23, 2005. Applicants appeal the final rejection of claims 1-17 and 19-21, which are copied in the attached CLAIMS APPENDIX.

STATUS OF AMENDMENTS

An Amendment After Final is enclosed with this brief amending claims 12, 14, 16 and 17. The amendments to claims 12, 14, 16 and 17 are reflected in the CLAIMS APPENDIX.

SUMMARY OF CLAIMED SUBJECT MATTER

Overview

The present invention is directed to, among other things, providing an inexpensive, easily manufactured and installed, reliable, and acceptable, from the standpoint of regulatory agencies, heads-up display ("HUD") for private and commercial automobiles and trucks. Significant differences between the claimed, present invention and far more expensive and complex HUD devices developed for combat aircraft and other expensive vehicles are, at least in part, motivated by the need to meet highway safety regulations and to address a market in which vehicle prices are significantly less, in general, than the cost for the complex HUD devices incorporated into expensive combat aircraft and commercial aircraft.

Independent Claim 1

Claim 1 is readily understood by reference to Figure 5 of the current application. Claim 1 claims a visual display system comprising a display light source (504 in Figure 5) that transmits an image in at least partially polarized light (508 in Figure 5), a combiner *positioned between the occupant and the windshield* (502 in Figure 5) that transmits light (510 in Figure 5) from a field of vision external to the vehicle to the occupant of the vehicle (512 in Figure 5), the combiner reflecting a first portion of the display light (520 in Figure 5), rotating the polarization of a second portion of the display light (518 in Figure 5), and transmitting the second portion of the display light through the windshield (506 in Figure 5).

Dependent Claims 2–12 and 19-20

Claim 2 further defines the light transmitted by the display light source as *s*-polarized. Claim 3 specifies that the combiner consists of a birefringent material. Claim 4 specifies that the combiner is coated with a birefringent film. Claim 5 specifies that the combiner is coated with a dielectric film. Claim 6 specifies that the combiner is coated with a metallic film. Claims 7-8 indicate that the visual display system of claim 1 is used in a head-up display for an automobile with either only attenuated ghost images or with no ghost images, respectively. Claim 9 specifies further applications of the visual display of claim 1. Claim 10 includes a relay optic in the visual display system. Claim 11 specifies that the relay optic of claim 10 allows a viewer to wear *p*-polarized sunglasses and still see the head-up display. Claim 12 indicates various types of display light sources. Claim 19 specifies a combiner coated with both dielectric and metallic films, and claim 20 specifies applying the combiner to an inner surface of a windshield.

Independent Claim 13

Claim 13 is directed to a visual display system similar to that to which claim 1 is directed, but in which the display light source transmits an image in at least partially *p*-polarized light. This visual display system also includes a *combiner*, coated with a metallic coating, *positioned between the occupant and the windshield.*

Dependent Claim 14

Claim 14 further specifies that the visual display system allows a viewer to use *p*-polarized sunglasses.

Independent Claim 15

Independent claim 15 is directed to a method for superimposing a virtual image onto a field of vision of an occupant of a vehicle. The method of claim 15 is directed to use of the visual display system to which claim 1 is directed. The method of claim 15 employs a *combiner positioned between the occupant and the windshield.*

Dependent Claims 16-17

Dependent claims 16 and 17 further specify the method of claim 15 as being employed to provide a head-up display and a see-through display projector, respectively.

Independent Claim 21

Independent claim 21 is directed to a visual display system similar to the visual display system to which claim 1 is directed. However, claim 21 adds a relay optic (702 in Figure 7) that rotates the polarization of the reflected, first portion of the display light to direct *p*-polarized light to the vehicle occupant.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether claims 1, 2, 7, 9-12, 15-17, and 21 are obvious under 35 U.S.C. §103(a) over McDonald, U.S. Patent No. 5,212,471 ("McDonald") in view of Freeman, U.S. Patent Publication No. US2004/0109251 A1 ("Freeman").

2. Whether claims 3, 4, and 8 are obvious under 35 U.S.C. §103(a) over McDonald in view of Freeman and further in view of Weber et al., U.S. Patent Publication No. US2004/0135742 A1 ("Weber").

3. Whether claims 5, 6, 10, 13, 14, 19, and 20 are obvious under 35 U.S.C. §103(a) over McDonald in view of Freeman and further in view of Sebastiano et al., U.S. Patent No. 5,143,796 ("Sebastiano").

ARGUMENT

Claims 1-17 and 19-21 are pending in the current application. In an Office Action dated June 23, 2005 ("Office Action"), the Examiner rejected claims 1,2, 7, 9-12, 15-17, and 21 under 35 U.S.C. §103(a) as being unpatentable over McDonald in view of Freeman, rejected claims 3, 4, 8 under 35 U.S.C. §103(a) as being unpatentable over McDonald in view of Freeman and further in view of Weber, and rejected claims 5, 6, 10, 13, 14, 19, and 20 under 35 U.S.C. §103(a) as being unpatentable over McDonald in view of Freeman and further in view of Sebastiano. Applicants' representative respectfully traverses the 35 U.S.C. §103(a) rejection of claims 1-17 and 19-21.

ISSUE 1

1. Whether claims 1, 2, 7, 9-12, 15-17, and 21 are obvious under 35 U.S.C. §103(a)

over McDonald, U.S. Patent No. 5,212,471 ("McDonald") in view of Freeman, U.S. Patent Publication No. US2004/0109251 A1 ("Freeman").

The independent claims of the current application are directed to a visual-display system, or method for visual display, in which "a combiner positioned between the occupant and the windshield that transmits light from a field of vision external to the vehicle to the occupant." As stated in an Office Action response, filed on April 28, 2005:

> MacDonald does not anticipate claim 1. MacDonald discloses a HUD implementation in which "a half-wave retarder [15 which] is interposed between the inside and outside air interfaces of the windshield in the region of the combiner element" (MacDonald, column 2, lines 12-14). In other words, MacDonald discloses a HUD that embeds a combiner within a windshield of a vehicle. By contrast, the combiner element claimed in independent claims 1, 13, and 15 is "positioned between the occupant and the windshield." This difference is significant. Embedding a combiner within a windshield involves an expensive redesign of automobile windshields, additional alignment requirements during car manufacturer, standards issues, and a host of other issues. By contrast, by either applying a film-based combiner to the inside of a windshield, or by otherwise attaching a combiner within an already manufactured automobile, Applicants' HUD can be more economically and easily manufactured and installed. Because of the different positioning of the combiner in MacDonald's HUD and the HUD of the present invention, optical characteristics of the combiner may be quite different. Display light transmitted by a display light source, in MacDonald's system, must first traverse a windshield optical boundary before reaching the combiner. The initial optical boundary serves as the reflective element in MacDonald's system. In Applicants' currently claimed HUD, by contrast, the display light first impinges on the combiner, which reflects the image into the field of view of a vehicle occupant. The combiner of the present invention may therefore provide for higher reflectivity of the display light, allowing for significantly lower intensity light sources. The currently claimed system may also more effectively extinguish potential ghost images. Furthermore, the presently claimed HUD combiner allows for a much wider range of materials and coatings to be used in the combiner, in contrast to a combiner embedded within a windshield during high-temperature and potentially chemically destructive manufacturing processes.

In the Office Action, the Examiner admits that MacDonald fails to recite a combiner positioned between the occupant and the windshield in each of multiple rejections of independent claims. The Examiner then states:

> However, Freeman teaches a visual display system (page 1, paragraph 5, Lines 1-4) that superimposes a virtual image onto a field of vision of an occupant of a vehicle that includes a windshield, the visual display system (page 1, paragraph 6; page 3, paragraph 39-40; page 2, paragraph 30) comprising: a combiner positioned between the occupant (viewer) and the windshield (page 1, paragraph 6; page 2, paragraph 27; page 3, paragraphs 39-41).

The cited portions of Freeman do not teach a combiner positioned between the occupant and the windshield. On lines 1-4 of paragraph [0005], Freeman states that a head-up display system superimposes information onto a viewer's field of view. In paragraph [0006], Freeman mentions a combiner only in the following sentence:

> The collimated light is then reflected off the combiner, which is in the vehicle operator's field of view.

Thus, paragraph [0006] says nothing about the position of the combiner, or whether the combiner is separate from, or included within, a windshield. In paragraph [0039], Freeman states that the disclosed head-up display system uses "*an automotive windshield as the combiner.*" (emphasis added) Further in the paragraph, Freeman states that "[l]ight rays emanate from the image source 14 and are projected onto the *windshield 12, which operates as a combiner.*" (emphasis added) Paragraph [0040] of Freeman does not further mention the combiner. In paragraph [0041], Freeman states that the "following discussion will be directed towards the use of a prior art *windshield which incorporates an interlayer* having a constant thickness, *as the combiner in a head-up display.*" (emphasis added) In short, like McDonald, Freeman does not teach, mention, or suggest a combiner separate from a windshield that is positioned between the occupant and the windshield. Freeman repeatedly and explicitly states that the combiner is contained within the windshield, and shows the combiner incorporated within a windshield in Figures 5 and 6 of Freeman. Thus, neither McDonald, nor Freeman, nor McDonald and Freeman in combination teach, mention, or suggest the claimed visual display system of claim 1.

In rejecting claim 21, the Examiner states that McDonald discloses, on lines 5-25 of column 3, "a relay optic that rotates the polarization of the reflected, first portion of the display light to direct p-polarized light to the vehicle occupant." However, in the cited line of McDonald, McDonald discusses "the specific instance where the inside windshield air interface is utilized as the combiner element" (McDonald, column 3, lines 5-6). The relay

optic in claim 21 is claimed as a separate element, distinct from the windshield, and is so illustrated in Figure 9 (908) in the current application. McDonald does not disclose a separate relay optic on lines 5-25 of column 3. Thus, claim 21 is neither anticipated nor made obvious by McDonald, Freeman, or a combination of McDonald and Freeman.

ISSUE 2

2. Whether claims 3, 4, and 8 are obvious under 35 U.S.C. §103(a) over McDonald in view of Freeman and further in view of Weber et al., U.S. Patent Publication No. US2004/0135742 A1 ("Weber").

The rejection of claims 3, 4, and 8 rely primarily on McDonald and Freeman. As discussed above, neither McDonald, nor Freeman, nor Freeman and McDonald in combination teach, mention, or suggest a combiner separate from, and interposed between, a windshield and an occupant. Since claims 3, 4, and 8 depend from claim 1, claims 3, 4, and 8 are therefore not made obvious by any combination of the cited references.

ISSUE 3

3. Whether claims 5, 6, 10, 13, 14, 19, and 20 are obvious under 35 U.S.C. §103(a) over McDonald in view of Freeman and further in view of Sebastiano et al., U.S. Patent No. 5,143,796 ("Sebastiano").

The rejection of claims 3, 4, and 8 rely primarily on McDonald and Freeman. As discussed above, neither McDonald, nor Freeman, nor Freeman and McDonald in combination teach, mention, or suggest a combiner separate from, and interposed between, a windshield and an occupant. Since claims 3, 4, and 8 depend from claim 1, claims 3, 4, and 8 are therefore not made obvious by any combination of the cited references.

CONCLUSION

In a previous response, Applicants' representative apparently successfully argued that the cited references, including McDonald, do not teach or suggest a head-up display system in which a combiner is interposed between a windshield and a vehicle occupant. The Examiner acknowledges McDonald does not teach such a combiner in the Office Action.

Inexplicably, the Examiner has added the reference Freeman to overcome this deficiency in the cited reference McDonald. However, as clearly and explicitly stated by Freeman, Freeman's head-up display incorporates the combiner within a windshield as an internal layer embedded within the laminated windshield. Neither McDonald, Freeman, nor a combination of Freeman and McDonald therefore teaches, mentions, or suggests the claimed invention,

Applicant respectfully submits that all statutory requirements are met and that the present application is allowable over all the references of record. Therefore, Applicant respectfully requests that the present application be passed to issue.

Respectfully submitted,
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CLAIMS APPENDIX

1. A visual display system that superimposes a virtual image onto a field of vision of an occupant of a vehicle that includes a windshield, the visual display system comprising:

a display light source that transmits an image in at least partially polarized light; and

a combiner positioned between the occupant and the windshield that transmits light from a field of vision external to the vehicle to the occupant, the combiner

reflecting a first portion of the display light to superimpose the image as a virtual image within the transmitted field of vision,

rotating the polarization of a second portion of the display light, and

transmitting the second portion of the display light through the windshield, the second portion of the light having low efficiency for reflection towards the viewer from windshield-related optical boundaries encountered by the second portion of the display light following rotation of the plane of polarization of the display light and transmission by the combiner.

2. The visual display system of claim 1 wherein the light is *s*-polarized, and the polarization of the light is rotated by the combiner to produce *p*-polarized light.

3. The visual display system of claim 1 wherein the combiner consists of a birefringent material.

4. The visual display system of claim 1 wherein the combiner is coated with a birefringent film.

5. The visual display system of claim 1 wherein the combiner is coated with a dielectric film.

6. The visual display system of claim 1 wherein the combiner is coated with a metallic film.

7. The visual display system of claim 1 used in a head-up display, providing a primary virtual image of an automotive gauge with only attenuated ghost images.

8. The visual display system of claim 1 used in a head-up display, providing a primary

virtual image of an automotive gauge with no ghost images.

9. The visual display system of claim 1 used in an application selected from among:

a see-through projection display; and

a head-up display in a vehicle.

10. The visual display system of claim 1 further including a relay optic that rotates the polarization of the reflected, first portion of the light.

11. The visual display system of claim 10 used in a head-up display to allow a viewer to wear *p*-polarized sunglasses.

12. The visual display system of claim 10 wherein the display light source is selected from among:

a display projection system utilizing a light guide, diffuser, liquid crystal display, and transmitting window;

a vacuum fluorescent display;

a laser or light emitting diode combined with a scanning mirror;

a laser or light emitting diode combined with a number of lasers, LEDs, and scanning mirrors;

a laser or LED combined with scanning lenses; and

an array of LEDs that together compose a graphical or textual display.

13. A visual display system that superimposes a virtual image onto a field of vision of an occupant of a vehicle that includes a windshield, the visual display system comprising:

a display light source that transmits an image in an at least partially *p*-polarized light; and

a combiner, coated with a metallic coating, positioned between the occupant and the windshield that transmits light from a field of vision external to the vehicle to the occupant, the combiner

reflecting a first portion of the display light to superimpose the image as a virtual image within the transmitted field of vision, and

transmitting a second portion of the display light, the second portion of the

display light having low efficiency for reflection towards the viewer from optical boundaries encountered by the second portion of the display light following transmission into the combiner.

14. The visual display system of claim 13 used in a head-up display to allow a viewer to wear *p*-polarized sunglasses.

15. A method for superimposing a virtual image onto a field of vision of an occupant of a vehicle that includes a windshield, the method comprising:

transmitting an image in an at least partially polarized light from a display light source to a combiner positioned between the occupant and the windshield that transmits light from a field of vision external to the vehicle to the occupant, the combiner

reflecting a first portion of the display light to superimpose the image as a virtual image within the transmitted field of vision,

rotating the polarization of a second portion of the display light, and

transmitting the second portion of the display light through the windshield, the second portion of the light having low efficiency for reflection towards the viewer from windshield-related optical boundaries encountered by the second portion of the display light following rotation of the plane of polarization of the display light and transmission by the combiner.

16. The method of claim 15 employed to provide a head-up display.

17. The method of claim 15 employed to provide a see-through display projector.

18. canceled

19. The visual display system of claim 1 wherein the combiner is coated with both a dielectric film and a metallic film.

20. The visual display system of claim 1 wherein the combiner is applied to an inner surface of the windshield.

21. A visual display system that superimposes a virtual image onto a field of vision of an occupant of a vehicle that includes a windshield, the visual display system comprising:

a display light source that transmits an image in at least partially polarized light;

a combiner that transmits light from a field of vision external to the vehicle to the occupant, the combiner

reflecting a first portion of the display light to superimpose the image as a virtual image within the transmitted field of vision,

rotating the polarization of a second portion of the display light, and

transmitting the second portion of the display light through the windshield, the second portion of the light having low efficiency for reflection towards the viewer from windshield-related optical boundaries encountered by the second portion of the display light following rotation of the plane of polarization of the display light and transmission by the combiner; and

a relay optic that rotates the polarization of the reflected, first portion of the display light to direct *p*-polarized light to the vehicle occupant.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.